UNITRON

INSTRUMENT DIVISION of UNITED SCIENTIFIC CO.
204-206 MILK STREET BOSTON 9, MASSACHUSETTS

INSTRUCTIONS for UNITRON ASTRO-CAMERA Model 220

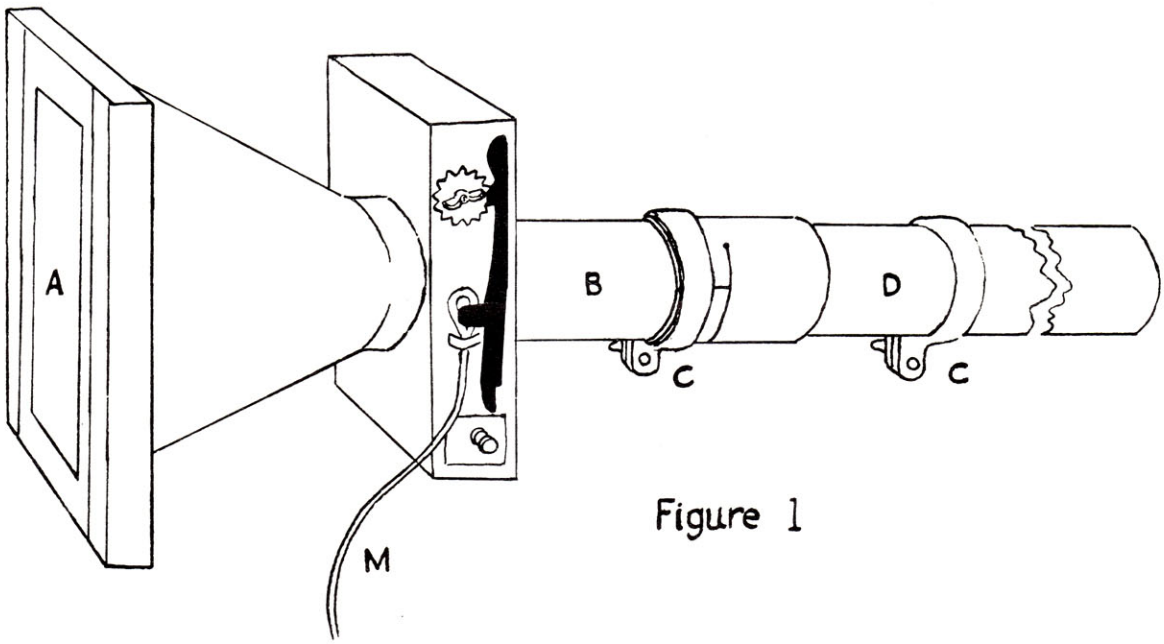


Figure 1

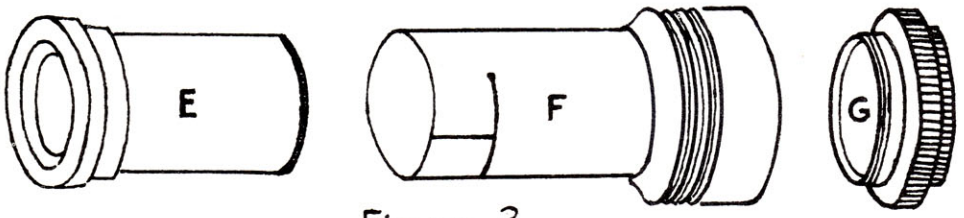


Figure 2

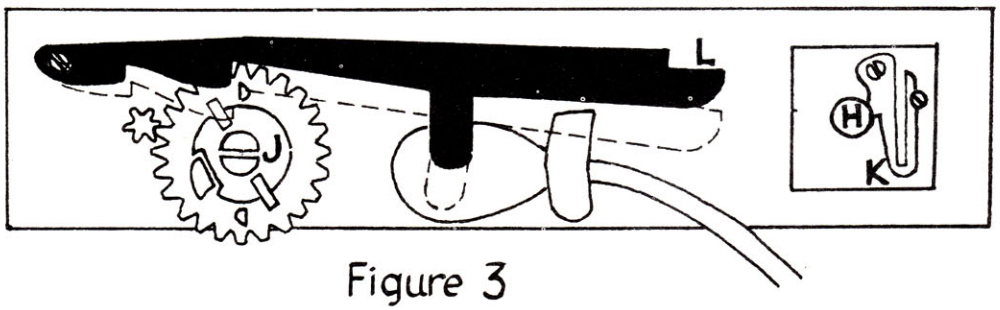


Figure 3

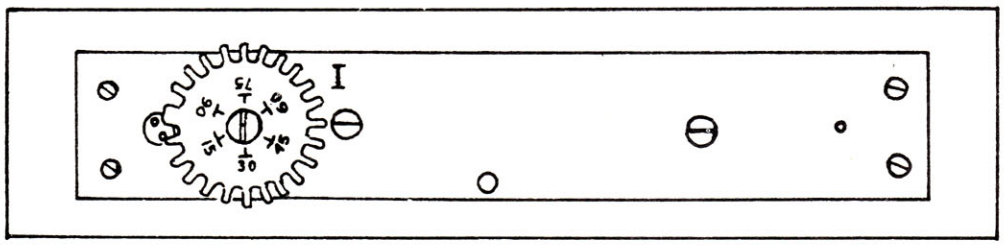


Figure 4

A. Ground glass screen

B. Camera tube

C. Clamps

D. Extension tube

E. Eyepiece

F. Eyepiece holder

G. Filter

H. Speed selector knob

I. Shutter speed indicator

J. Shutter winding knob

K. Lever to unwind shutter

L. Shutter release lever

M. Rubber tube from shutter release bulb

UNITRON INSTRUMENT COMPANY — TELESCOPE SALES DIV.
66 NEEDHAM STREET, NEWTON HIGHLANDS 61, MASS.

INSTRUCTIONS FOR UNITRON ASTRO-CAMERA 220, MODELS A & B

INTRODUCTION: This light-weight camera has been designed especially for astronomical photography, using the objective (or mirror) of your telescope as the principle optical element. Attached to an altazimuth telescope, Astro-Camera 220 can be used for photographing the sun and sunspots, the moon, and solar and lunar eclipses. These subjects require only very short exposure times, during which the telescope may remain stationary. If your telescope is equatorially mounted, preferably with a clockdrive, many other celestial objects requiring longer exposures are within your reach; planets, comets, star fields, star clusters, and nebulae.

Taking first-class celestial photographs is an accomplishment in which you can feel pride. Become familiar with your Astro-Camera before using it so that you may operate it in the dark with ease. Take care to focus accurately. Since in astronomical photography the proper exposure time will depend on unpredictable factors such as atmospheric transparency, it is well to take a series of shots with varying exposures. You will find it most helpful to keep a careful record of the exposure time, type of film or plate, and development for each photograph. In this way, you can profit by your experience to find the most suitable combination for a particular subject.

LIST OF PARTS:

1. Camera with ground-glass focusing back.
2. Camera tube with eyepiece holder.
3. Extension tube
4. Two clamps
5. 30mm focal length eyepiece
6. Yellow filter
7. 3 double plateholders for 3-1/4" x 4-1/4" plates or cut film
8. Cabinets

THE PLATEHOLDERS: Three double plateholders are furnished with Astro-Camera 220. Extra double plateholders are available at an additional cost of $6.00 each. The plateholders are designed to use either 3-1/4" x 4-1/4" glass plates or cut film. In the case of cut film, adapters must be used. Cut film adapters may be obtained from a photographic dealer or may be purchased directly from UNITRON Instrument Division at a cost of $3.50 for a set of 6.

To insert the plateholders in the camera, unlock the catch at the top of the camera, swing the ground glass frame downward on its hinges, and slip the plateholders into position. Secure the plateholder in place using the two locks at the top. Prior to exposing the film with the camera shutter, the plateholder slide is pulled upward. Note that this slide is designed so that it cannot be completely removed from the plateholder; this makes it easy to replace the slide after the exposure has been made.

ATTACHING THE CAMERA TO YOUR TELESCOPE: Photographs may be taken with Astro-Camera 220 in the following two ways.

I. Photography at the prime focus: For this type of photography, the camera is positioned so that the plane of the film falls at the prime focus of the objective or mirror. A relatively small image is produced but exposure time will be less than with the method of photography by projection described in II, below. In this case, only the shorter camera tube (B) is used, and without the camera eyepiece. The camera tube screws onto the end of the camera body as shown in Figure 1. The camera tube of Model 220-A is of the same diameter as the UNITRON drawtube and fits into the UNITRON rack and pinion focusing sleeve. The camera tube of Model 220-B fits into 1-1/4" diameter eyepiece holders. In either case, use of the clamps (C) to insure a tight connection between the camera tube and rack and pinion sleeve (Model A) or 1-1/4" telescope eyepiece holder (Model B).

II. Photographs by Projection: With this method, an enlarged image is projected onto the film by the 30mm eyepiece. Place the eyepiece (E) in the eyepiece holder (F). (Other UNITRON eyepieces of relatively long focal length may also be used in the camera and you may wish to experiment with these.) Insert the camera tube (B) into the extension tube (D) and lock the two together using one of the clamps. Insert the extension tube into the UNITRON rack and pinion sleeve (Model A) or 1-1/4" eyepiece holder (Model B) and fasten using the second clamp.

Balance the telescope carefully after attaching the camera. For UNITRON models in which the tube mounts in a saddle, this can be done by sliding the tube in the saddle until balance is obtained.

Counterweights are available to attach to the tube for models using a different fastening arrangement. These are listed in the Accessories Price List of the UNITRON Catalog.

Operating the Shutter: Astro-Camera 220 uses an air operated, curtain shutter of the Thornton Pickard type. Speeds of 1/15-1/90 second bulb and time may be obtained. As the speed selector knob (H) is turned, the tension on the curtain shutter mechanism is increased so that shorter exposures result. The actual shutter speed which will be obtained for any given setting of the knob is indicated by the dial (I). To set the shutter speed to a lower value than indicated by the dial, merely push the lever (K) to the right (which will unwind the shutter) and rewind to the desired speed.

The shutter release lever (L) may assume two positions. In the position shown in figure 3, the shutter is used for taking instantaneous exposures between 1/15-1/90 second.

To move the lever to its second position, as indicated by the dotted lines in figure 3, press the end of lever (L) and move it downward. This second position is used for taking "bulb" exposures.

To wind the shutter for an exposure, turn the knob (J) one complete revolution clockwise. Two clicks will be heard during the turning of the knob. When the lever (L) is in position for instantaneous photography, squeezing the rubber bulb shutter release will give a film exposure corresponding to the reading shown on the dial (I). When the lever (L) is the position for "Bulb", squeezing the rubber bulb will open the shutter and it will remain open until pressure on the bulb is released.

For a "time" exposure, position the lever (L) in the position for instantaneous photography and turn the shutter winding knob (I) clockwise one-half a revolution until a single click is heard. This will open the shutter. Squeezing the rubber bulb will close the shutter and end the exposure.

Look into the opening in front of the camera and note that as you turn the shutter winding knob (J), the slit in the curtain moves across the opening and admits light into the camera. Therefore, the knob (J) should never be turned unless the plateholder slide is closed; otherwise, accidental exposure of the film will result. It is a good rule always to squeeze the rubber bulb before withdrawing the plateholder slide to insure that the shutter is closed.

Focusing the Camera: The quality of your picture will depend critically on the pains taken in securing the sharpest possible image on the ground-glass screen. If the image is too faint for sharp focusing, as may be the case with stars, spread on a thin film of glycerin on the ground side of the glass screen to brighten the image.

When taking photographs with a refractor, remember that the optical correction of the objective is for visual (yellow) light with the result that without a filter the position of sharpest focus as seen on the ground glass is not necessarily the position of sharpest focus for the film. In this case, keep the yellow filter on the camera tube, and use a panchromatic emulsion. If a reflecting telescope is used, the filter may be removed except for solar photography.

Photographing the Sun: The sun is unique among subjects for astronomical photography in providing too much light, rather than too little. Therefore, use slow, fine grain film the shortest exposure time, and always use the yellow filter. A solar aperture diaphragm is provided as standard equipment with the UNITRON 4" models and should be used to reduce the amount of light entering the telescope. Solar aperture diaphragms are available for the 2.4" models at a cost of 75¢ postpaid and for the UNITRON 3" models at a cost of $1.00 postpaid.

The solar heat concentrated at the focus of your telescope is so great that care must be taken not to damage the cloth curtain of the shutter. The practical rule is never to let the sun's heat fall on the shutter for more than a few seconds at a time. Keep the dustcap on the objective until you are ready to focus. Open the shutter, remove the dustcap and focus. Replace the dustcap and close the shutter. Insert the plateholder and withdraw the plateholder slide. Replace the dustcap by the solar aperture diaphragm, if one is used. Then, as rapidly as possible, make the exposure and replace the solar aperture diaphragm by the dustcap. Close the plateholder slide.

Lunar Photography: Whether you use prime focus photography or take an enlarged picture through the eyepiece, it is advisable to use the fastest available emulsion. Since the surface brightness of the moon changes very markedly with phase, no simple rule for exposure time can be given, although this will usually be in the range between 1/15 and 1/90 second. For best results, make a series of shots with different exposure lengths.

Stellar and Planeatary Photography: The chief consideration here is that the objects are faint light sources. The fastest available emulsion should be used, together with long exposures, often 30 minutes or longer. For long exposures, only an equatorially mounted telescope can be used, and preferably it should have a clockdrive. For good results, careful and continuous guiding is necessary. This means, a guide star must be kept on the crosshairs in the guiding telescope throughout the exposure. Whenever the guide star drifts perceptibly from the intersection of the cross hairs, the star is brought back with the aid of the telescope slow motions.

References on Astro-Photography: A most useful book for the amateur, unfortunately long out of print but available in some large libraries and from some booksellers is E. S. King, A MANUAL OF CELESTIAL PHOTOGRAPHY, 1931, (Eastern Science Supply Company).

A book for the beginning amateur is
R. N. and M. L. Mayall, SKYSHOOTING, 1949, (Ronald Press).

The more advanced amateur will find a summary of the principles in chapter 20 of J. B. Sidgwick, AMATEUR ASTRONOMER'S HANDBOOK, 1956 (Macmillan).

Written on a considerably more technical level is E. W. H. Selwyn, PHOTOGRAPHY IN ASTRONOMY, 1950, (Eastman Kodak Co.)

Helpful information for someone planning to specialize in lunar photography can be found in Appendix 1 of
H. P. Wilkins, and P. Moore, THE MOON, 1956 (Macmillan)

Lastly, there are frequent short articles and letters on amateur astro-photography in the magazines Sky & Telescope and the Journal of the British Astronomical Association, giving much useful information.